WHAT IS CLAIMED IS:

1. A surface optical device apparatus comprising:

a surface optical device, said surface optical device being capable of emitting or receiving light through a surface of said surface optical device; and

a thick layer formed of a radiation-curable or electron-beam-curable material, in which a guide hole for inserting an end portion of a light-transmission member therein is formed at a position corresponding to said surface of said surface optical device such that said surface optical device can be optically coupled to the light-transmission member inserted in said guide hole, wherein said guide hole is formed in said thick layer by performing a patterning on said thick layer using photolithography to selectively harden said thick layer and developing said thick layer.

2. The surface optical device apparatus of claim 1, wherein said curable material is a polymerizable resist.

3. The surface optical device apparatus of claim 1, wherein a thickness of said thick layer is in a range between 10μm and 1000μm.

4. The surface optical device apparatus of claim 1, wherein said thick layer comprises a lower layer with a hole a size of which is smaller than a size of the light-transmission member and which transmits light therethrough, and an upper layer, formed on said lower layer, with a guide hole for fixing the light-transmission member therein, and a distance between said surface of said surface optical device and an end face of said

light-transmission member is regulated by a thickness of said lower layer.

5. The surface optical device apparatus of claim 1, wherein said guide hole is contoured corresponding to an outer shape of the light-transmission member.

6. The surface optical device apparatus of claim 1, wherein said guide hole consists of a portion contoured corresponding to an outer shape of the light-transmission member and a groove connected to said portion.

7. The surface optical device apparatus of claim 1, wherein a plurality of said surface optical devices are arrayed, and a plurality of said guide holes are arrayed corresponding to said arrayed surface optical devices.

8. The surface optical device apparatus of claim 1, wherein said surface optical device comprises a surface light-emitting device only.

9. The surface optical device apparatus of claim 1, wherein said surface optical device comprises a surface light-receiving device only.

10. The surface optical device apparatus of claim 1, wherein there is a plurality of surface optical devices and said plurality of said surface optical devices comprise at least a surface light-emitting device and at least a surface light-receiving device.

11. The surface optical device apparatus of claim 8, wherein said surface light-emitting device comprises a vertical cavity surface emitting

laser (VCSEL).

12. The surface optical device apparatus of claim 10, wherein said surface light-emitting device comprises a vertical cavity surface emitting laser (VCSEL).

13. The surface optical device apparatus of claim 8, wherein said surface light-emitting device comprises a surface emitting laser with only a functional layer including an active layer, a cavity layer and distributed Bragg reflector (DBR) mirror layers sandwiching said active layer.

14. The surface optical device apparatus of claim 10, wherein said surface light-emitting device comprises a surface emitting laser with only a functional layer including an active layer, a cavity layer and distributed Bragg reflector (DBR) mirror layers sandwiching said active layer.

15. The surface optical device apparatus of claim 8, wherein said surface light-emitting device comprises a light emitting diode (LED).

16. The surface optical device apparatus of claim 10, wherein said surface light-emitting device comprises a light emitting diode (LED).

17. The surface optical device apparatus of claim 1, wherein said surface optical device comprises a thinned surface optical device without a growth substrate or with a thinned growth substrate.

18. The surface optical device apparatus of claim 1, wherein said surface optical device comprises a surface optical device with a growth substrate.

19. An optical apparatus comprising:

a substrate;

a surface optical device arranged on said substrate, said surface optical device being capable of emitting or receiving light through a surface of said surface optical device;

a light-transmission member optically coupled to said surface optical device; and

a thick layer formed of a radiation-curable or electron-beam-curable material, in which a guide hole for inserting an end portion of said light-transmission member therein is formed at a position corresponding to said surface of said surface optical device such that said surface optical device is optically coupled to said light-transmission member inserted in said guide hole, wherein said guide hole is formed in said thick layer by performing a patterning on said thick layer using photolithography to selectively harden said thick layer and developing said thick layer.

20. The optical apparatus of claim 19, further comprising an electronic device provided on said substrate in a hybrid manner, said electronic device being electrically connected to said surface optical device.

21. The optical apparatus of claim 19, wherein a plurality of said

surface optical devices are arrayed, and a plurality of said guide holes are arrayed corresponding to said arrayed surface optical devices.

22. The optical apparatus of claim 19, wherein said light-transmission member comprises an optical fiber.

23. The optical apparatus of claim 22, wherein said optical fiber comprises a polymer-containing plastic optical fiber.

24. The optical apparatus of claim 22, wherein said optical fiber comprises a silica-containing optical fiber.

25. The optical apparatus of claim 22, further comprising a resin filling a space between an end face of said optical fiber and said surface optical device.

26. The optical apparatus of claim 25, wherein said resin is a curable resin.

27. The optical apparatus of claim 26, wherein said curable resin is an optical adhesive or a transparent resin.

28. The optical apparatus of claim 23, wherein said optical fiber comprises a polymer-containing plastic optical fiber with a lens-shaped end portion.

29. The optical apparatus of claim 28, wherein said lens-shaped

end portion of said polymer-containing plastic optical fiber is shaped into a concave portion, and said concave portion is filled with a resin having a refractive index larger than a refractive index of said plastic optical fiber.

30. The optical apparatus of claim 28, wherein said lens-shaped end portion of said polymer-containing plastic optical fiber is shaped into a convex portion, and a space between said convex portion and said surface optical device is filled with a resin having a refractive index smaller than a refractive index of said plastic optical fiber.

31. The optical apparatus of claim 28, wherein a space between an end face of said optical fiber and said surface optical device is filled with an inert gas.

32. The optical apparatus of claim 28, wherein said lens-shaped end portion of said polymer-containing plastic optical fiber is shaped into a convex portion.

33. The optical apparatus of claim 28, wherein said lens-shaped end portion of said polymer-containing plastic optical fiber is formed by pressing an end face of said optical fiber against a heated concave or convex mold.

34. The optical apparatus of claim 28, wherein said lens-shaped end portion of said polymer-containing plastic optical fiber is formed by immersing an end portion of said optical fiber in an organic solvent and

lifting said end portion from the organic solvent to dry said end portion.

35. The optical apparatus of claim 23, wherein said plastic optical fiber is a perfluorinated-polymer-containing optical fiber.

36. The optical apparatus of claim 23, wherein said plastic optical fiber is a polymethylmethacrylate (PMMA)-containing optical fiber.

37. The optical apparatus of claim 19, wherein said substrate is formed of a material which has a heat sink function.

38. An optical wiring apparatus in a form of an optical interconnection module for performing an optical interconnection between boards in electronic equipment, said apparatus comprising:

a substrate;

a surface optical device arranged on said substrate, said surface optical device being capable of emitting or receiving light through a surface of said surface optical device;

a light-transmission member optically coupled to said surface optical device to perform optical transmission and reception through said light-transmission member;

a thick layer formed of a radiation-curable or electron-beam-curable material, in which a guide hole for inserting an end portion of said light-transmission member therein is formed at a position corresponding to said surface of said surface optical device such that said surface optical device is optically coupled to said light-transmission member inserted in said guide hole, wherein said guide hole is formed in said thick layer by performing a patterning on said thick layer using

photolithography to selectively harden said thick layer and developing said thick layer;

an electronic circuit for driving and controlling said surface optical device, said electronic circuit being provided on said substrate and electrically connected to said surface optical device; and

a base member with an electric connection lead for electrically connecting said surface optical device and said electronic circuit to the board in the electronic equipment, said substrate being attached on said base member, and said electric connection lead being fixed to said base member and being electrically connected to said surface optical device and said electronic circuit.

39. The optical wiring apparatus of claim 38, wherein said light-transmission member comprises an optical fiber.

40. An optical wiring apparatus in a form of an electric connector for performing an optical interconnection between electronic equipment, said apparatus comprising:

a substrate;

a surface optical device arranged on said substrate, said surface optical device being capable of emitting or receiving light through a surface of said surface optical device;

a light-transmission member optically coupled to said surface optical device to perform optical transmission and reception through said light-transmission member;

a thick layer formed of a radiation-curable or electron-beam-curable material, in which a guide hole for inserting an end

portion of said light-transmission member therein is formed at a position corresponding to said surface of said surface optical device such that said surface optical device is optically coupled to said light-transmission member inserted in said guide hole, wherein said guide hole is formed in said thick layer by performing a patterning on said thick layer using photolithography to selectively harden said thick layer and developing said thick layer;

an electronic circuit for driving and controlling said surface optical device, said electronic circuit being provided on said substrate and electrically connected to said surface optical device; and

an electric connection pin for electrically connecting said surface optical device and said electronic circuit to the electronic equipment, said electric connection pin being electrically connected to said surface optical device and said electronic circuit, and said electric connection pin being removably connectable to a receptacle in the electronic equipment.

41. The optical wiring apparatus of claim 40, wherein said light-transmission member comprises an optical fiber.

42. A method of fabricating a plurality of optical apparatuses in a collective manner, said method comprising the steps of:

(a) forming functional layers of surface optical devices on a growth substrate;

(b) forming a plurality of sets of electric wiring patterns on a plurality of respective areas of an implement substrate;

(c) bonding at least a surface optical device, which is cut from

the growth substrate with the functional layers of the surface optical devices, to each respective area of the implement substrate;

(d) forming a thick layer of a radiation-curable or electron-beam-curable material with a guide hole on each surface optical device using photolithography;

(e) implementing an electronic device on each respective area of the implement substrate in a flip-chip manner;

(f) dicing the implement substrate such that the respective areas of the implement substrate are separated from each other; and

(g) inserting a light-transmission member into each guide hole such that the surface optical device is optically coupled to the light-transmission member inserted in the guide hole.

43. The method of claim 42, wherein the light-transmission member is an optical fiber.